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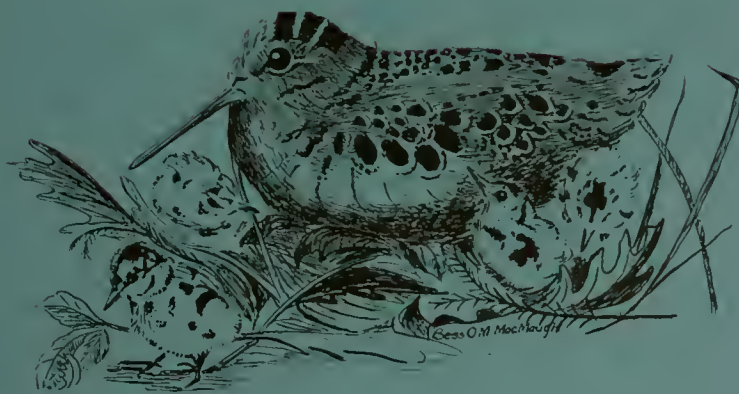
WOODCOCK STATUS REPORT

1969

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UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
Special Scientific Report — Wildlife No. 133

UNITED STATES DEPARTMENT OF THE INTERIOR, WALTER J. HICKEL, *SECRETARY*
Leslie L. Glasgow, *Assistant Secretary for Fish and Wildlife and Parks*
Fish and Wildlife Service, Charles H. Meacham, *Commissioner*
Bureau of Sport Fisheries and Wildlife, John S. Gottschalk, *Director*

WOODCOCK STATUS REPORT, 1969

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Bureau of Sport Fisheries and Wildlife
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CONTENTS

Abstract.....	iv
Introduction.....	1
Singing-ground survey	
Early methods.....	1
Random sampling studies.....	2
Procedures	
Random route establishment.....	2
Observer change.....	3
Audibility interference.....	3
Weighting factors.....	5
Results.....	6
Wing-collection survey.....	8
Procedures	
Wing-collection.....	8
Wing processing.....	9
Data analysis.....	9
Results.....	11
Comparison of sample source.....	11
Weighting factors.....	13
Productivity index.....	13
Hunter success index.....	14
Rangewide harvest.....	14
Research status.....	19
Acknowledgements.....	19
References.....	21
Appendix.....	23

ABSTRACT

Information on the current status and population trends of the American woodcock is provided by a singing-ground survey conducted over much of the species' breeding range and a wing-collection survey in the eastern United States. The 1969 singing-ground survey, in which 90 percent of the comparable routes were randomly located, indicated an increase in the breeding population of 4.22 percent in the Eastern Region, 12.14 percent in the Western Region, and 8.82 percent on a rangewide basis. The 1968-69 wing-collection survey suggested an increase in productivity of 5.36 percent, the first noticeable improvement since 1961-62. Daily harvest per hunter increased slightly in 1968-69 for the second consecutive year, but the seasonal harvest per hunter did not change. Although the sampling frame is inadequate the best available evidence suggests that the harvest of woodcock is increasing because more hunters are participating. The 1968-69 harvest in the United States approximated 1 million birds. The 1968 harvest in Canada was approximately 100,000 birds. There is some evidence that middle-latitude States could realize more recreational benefits from woodcock by adjusting their season to coincide with peaks of woodcock migration. Woodcock research has materially increased the past 2 years, chiefly through the Accelerated Research Program for Migratory Upland Game Birds.

INTRODUCTION

The American woodcock (Philohela minor) has long been a favorite game bird of a group of specialized hunters, and a welcome addition to the bag of other small game hunters. In recent years woodcock hunting has shown substantial gains in number of hunters participating, man-hours of recreation provided, and total harvest.

In addition to its role as a sterling game bird, the woodcock provides recreation for a rapidly increasing fraternity of bird watchers. The secretive habits of the species during much of the year make it a prized addition to the birders' lists in spring when the unique courtship display of the males may be observed by any who have learned to identify it.

Because the woodcock is migratory, its management in the United States is primarily a Federal responsibility. This obligation is carried out by the U.S. Department of the Interior's Bureau of Sport Fisheries and Wildlife under the terms of international treaties with Canada and Mexico.

To effectively manage woodcock for maximum long-term recreational return, the current status and recent trends of the population must be known. Two major surveys conducted in eastern North America each year provide that information: (1) a singing-ground survey, conducted each spring in most of the States and Provinces within the woodcock's primary breeding range, provides an index to the size of the breeding population; and (2) a wing-collection survey, conducted during the hunting season, furnishes an index to reproductive success and changes in distribution and size of the harvest.

This report reviews background material not previously assembled in one report, summarizes results of the 1969 singing-ground survey and the 1968-69 wing-collection survey, and discusses survey procedures and data analysis. The discussion of survey and analysis procedures, along with the background review, may be more important than the data on status to the many new workers in this field and to the veteran woodcock biologists who have not been closely associated with recent methods of handling these data.

SINGING-GROUND SURVEY

Early methods

Singing-ground surveys (counts of occupied woodcock singing grounds on sample areas) as a method of determining trends in the woodcock breeding population were initiated by Howard Mendall in Maine in 1937 (Mendall and Aldous, 1943). By 1953 this survey had expanded to include

most of the woodcock's principal breeding range (Aldrich, 1954), and methods were standardized according to the best information available at that time. Basically, the procedure consisted of an observer selecting a road which traversed territory where male woodcock had been observed in their courtship displays, traveling the road during the 30- to 35-minute period at dusk when male woodcock perform, stopping at each field or woods opening suitable for a woodcock singing ground, and counting the woodcock performing there. The minimum distance between stops was 0.4 mile, twice the maximum distance a woodcock can be heard "peenting," to prevent possible overlap in counts. Survey routes censused by this procedure are called management or nonrandom routes in this report.

Random sampling studies

Recognizing that random samples provide more useful data than non-random samples, pioneer studies in the randomization of singing-ground surveys were conducted in Michigan in 1962 and 1963 (Martin, 1964). A significant finding of these studies was that random samples showed a much higher woodcock breeding population index in the northern part of Michigan's Lower Peninsula than in the southern part. By contrast, the old nonrandom samples showed little difference between the indexes for the two regions. Because the southern region has a much higher proportion of open farm land and urban area, it supported fewer woodcock than the Upper Peninsula, where excellent woodcock habitat is abundant. Yet under the old system, the southern routes, selectively located in the few areas of available woodcock habitat, were weighted equally with routes in the north representing many more areas of available habitat. Randomly selected routes offer an efficient and effective alternative to modifications that would minimize the biases in the old method.

The old system may still offer advantages on relatively small, intensively managed areas where a much higher proportion of the population requires sampling. Also, it may be desirable for a short-term index to the breeding population of a larger area. However, for a long-term rangewide index of the woodcock breeding population, the random sample provides the most useful data obtainable within the limits of our funds and personnel.

Procedures

Random Route Establishment--The Michigan studies prompted efforts to extend the coverage of randomly located routes to as much of the woodcock breeding range as possible. West Virginia next established randomly located routes in 1965; and by 1967 the routes had been established in Delaware, Maryland, and Pennsylvania. In 1968 and 1969 conversion to randomly selected routes proceeded rapidly under the new Accelerated Research Program for Migratory Upland Game Birds in the

United States and with greater participation by Canadian Provinces. Ninety percent of the 1,115 census routes in 1969 were randomly located. Current status of this conversion is indicated in figure 1 and table 1. Limits of the woodcock's breeding range actually are much more irregular than the line on figure 1 indicates, depending upon presence of suitable habitat. Much of the area within that line not presently covered has very low breeding populations which do not warrant surveys. However, production in Quebec is a significant contribution to major harvest areas. Random coverage of southern Quebec and possibly Kentucky is needed.

Observer Change--Table 1 shows that comparable data were obtained from only 51 percent of the routes surveyed in 1969. Twenty-four percent were not comparable because they were newly established in 1969. Of 799 routes conducted both years, 188 (23 percent) were excluded from the index calculations because of changes in observers. While loss of the data is regrettable, two studies in Michigan showed that the exclusion was necessary (Goudy, 1960; Duke, 1966). More recently, counts in 1967 and 1968 on 33 Michigan routes where observers changed and 87 Michigan routes where observers did not change were subjected to a "t" test. There was a statistically significant difference at the 5 percent level ($P < .05$) in the 1967 to 1968 change in counts of woodcock heard when observers changed. Therefore, in calculating the breeding population index, we have decided against using results from routes where observers changed unless both old and new observers surveyed the routes in the year of change. This provides the continuity necessary for comparable data.

Audibility Interference--Another major influence on survey results has been interference in hearing the woodcock's "peent" due to extraneous noises such as those caused by frogs, traffic, or farm machinery. In previous years, when noise level at a route stop was so great that not all woodcock peenting could be heard, that stop was considered uncomparable and data for it were excluded in the following year's survey. In the index calculation for a given year, this procedure subjected each route to hearing interference adjustments for 2 years, the preceding as well as the current. If the number of comparable stops was reduced below five, the entire route was excluded from the index calculation that year.

The audibility factor imposes possible biases at two points in the survey: in the field if the cooperator decides that noise level is too high to record all the birds, and again when the person analyzing the data decides whether the noise recorded actually prevented the cooperator from hearing all woodcock peenting at the stop. Sometimes the latter is evident from the notation on the form, but more often it is not. A decision by the compiler is particularly difficult when both audibility interference and one or more peenting woodcock were recorded at a stop.

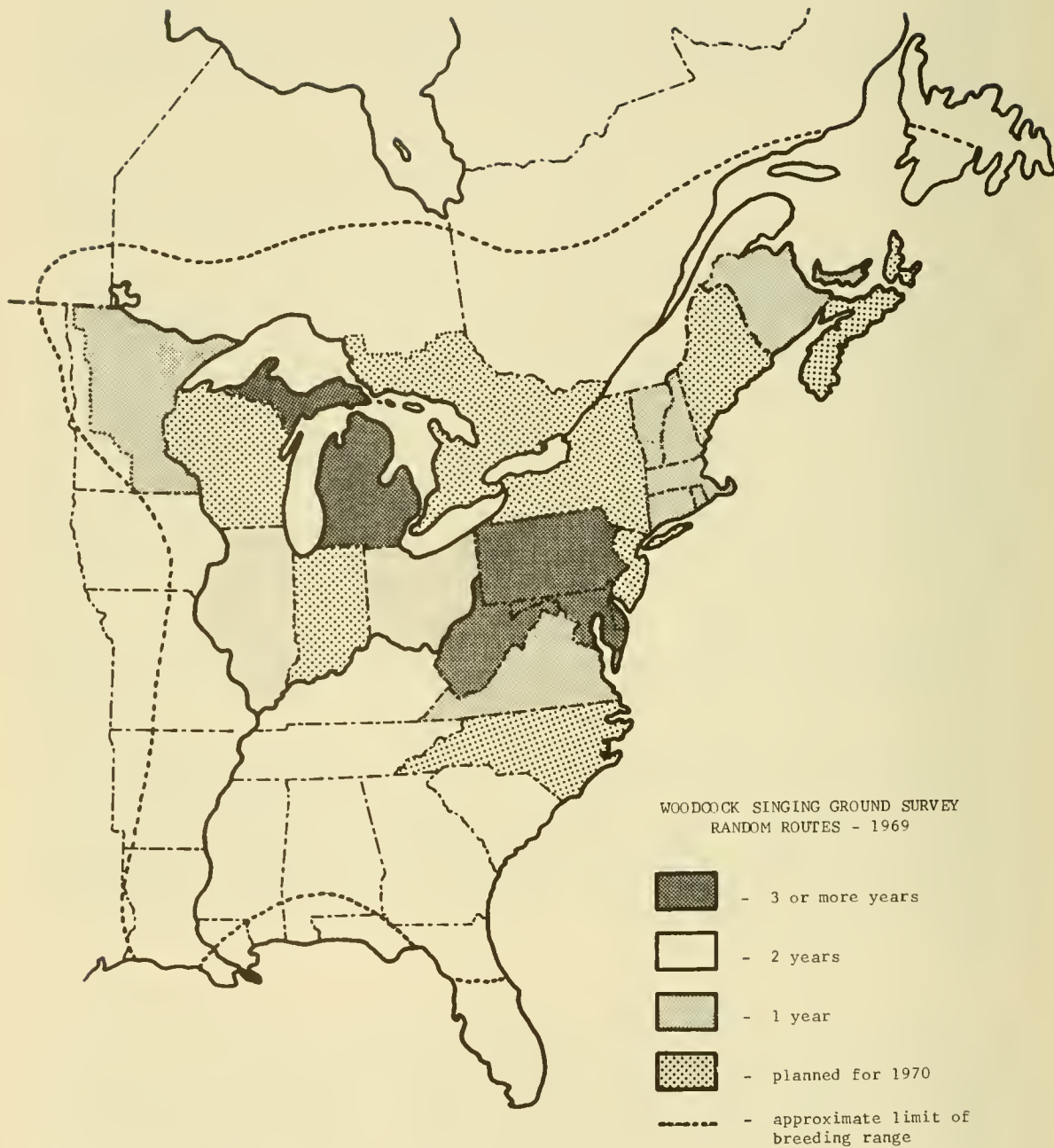


Figure 1.--Progress in randomizing woodcock singing-ground survey routes.

This year, with a larger sample size (number of routes) and a higher proportion of random routes averaging few birds per route, it was thought that the effects of hearing interference would be largely compensating. The 1968 to 1969 change in numbers of woodcock heard was tabulated twice in each of four States including high and low density breeding areas. In the first tabulation, stops with hearing interference were excluded while in the second those stops were included. In every State tested, there was no statistically significant difference at the 5 percent level ($P > .05$) in the 1968 to 1969 change in numbers of woodcock heard. Consequently, hearing interference was ignored in the 1969 singing-ground survey analysis. Any bias thus introduced is probably less than the biases associated with trying to evaluate audibility.

A limited number of routes not randomly located were checked in 1968 and 1969 to provide index continuity in States and Provinces converting to randomly located routes. In Maine, the only State where significant numbers of both nonrandom and random routes were checked, results of the two methods provide interesting comparisons (table 1). The number of birds heard per nonrandom route was much higher both years than the number heard on random routes. This was to be expected because nonrandom routes and stops were deliberately established in recognized woodcock habitat. By contrast, individual stops or even entire routes of the random type may be situated in habitat where woodcock are absent. Of greater significance, the nonrandom routes showed a decrease in woodcock heard per comparable route while random routes showed an increase, with the difference being statistically significant at the 5 percent level ($P < .05$). Thus, data from the two types could not be combined, because they showed opposite trends and only the random routes were used in computing the Maine breeding population index.

Weighting Factors--In arriving at regional^{1/} and rangewide indexes for the old singing-ground surveys, the data were weighted according to the area of uncultivated land in each State or Province represented. This was determined by subtracting the area of cropland as listed in table 811 of the 80th edition of Statistical Abstracts of the United States, 1959, from the total land area given in the 1959 edition of the Rand McNally Commercial Atlas and Marketing Guide (Robbins, 1960).

The random route system does not exclude cultivated land or urban areas. Therefore, in using that system, the total land area in each State or Province, as determined from Webster's New World Dictionary,

^{1/} The woodcock's breeding range is represented by two regions, roughly separated by the Appalachian range. Those Provinces and States touching the Atlantic Seaboard plus Vermont make up the Eastern Region. All other Provinces and States within the breeding range make up the Western Region.

is used for weighting purposes. Exceptions to this are Ontario and Minnesota where low productivity areas outside the woodcock's normal breeding range are excluded (fig. 1) and the sampled area was measured with a dot-grid scale. Randomization has progressed to the stage that 93 percent of the breeding range being sampled is surveyed by randomly selected routes (table 2).

Results

Weighted data for the 1969 survey showed a small increase (+ 4.22 percent) in woodcock heard per comparable route in the Eastern Region and a substantial increase (+ 12.14 percent) in the Western Region. On a rangewide basis, the change (+ 8.82 percent) was the first significant increase since 1964. The increase in the Western Region reversed a 4-year downward trend. Following is a summary of the annual changes for the past 5 years:

<u>Year</u>	<u>Eastern Region</u>	<u>Western Region</u>	<u>Rangewide</u>
1965	- 0.4%	- 11.1%	- 6.5%
1966	+ 2.4%	- 0.5%	+ 1.7%
1967	+ 1.5%	- 3.5%	0.0%
1968	- 8.4%	- 4.5%	- 6.9%
1969	+ 4.2%	+ 12.1%	+ 8.8%

Figure 2 shows annual percent changes in number of woodcock heard per comparable route, 1957-69, with 1968 used as the base year. Percentages were used instead of numbers of birds heard because the same routes are not comparable each year. The group of routes paired with comparable routes of the preceding year to determine percent change are not necessarily the same group of routes paired with comparable routes of the subsequent year. Comparison of 1966 to 1967 change with the 1967 to 1968 change illustrates this point:

<u>Year</u>	<u>Birds per route</u>		
	<u>1966</u>	<u>1967</u>	<u>1968</u>
Report Year 1967-68	4.11	3.82	
Report Year 1968-69		3.09	3.36

The incongruity is even greater during the period of transition to randomly selected routes where fewer woodcock are heard.

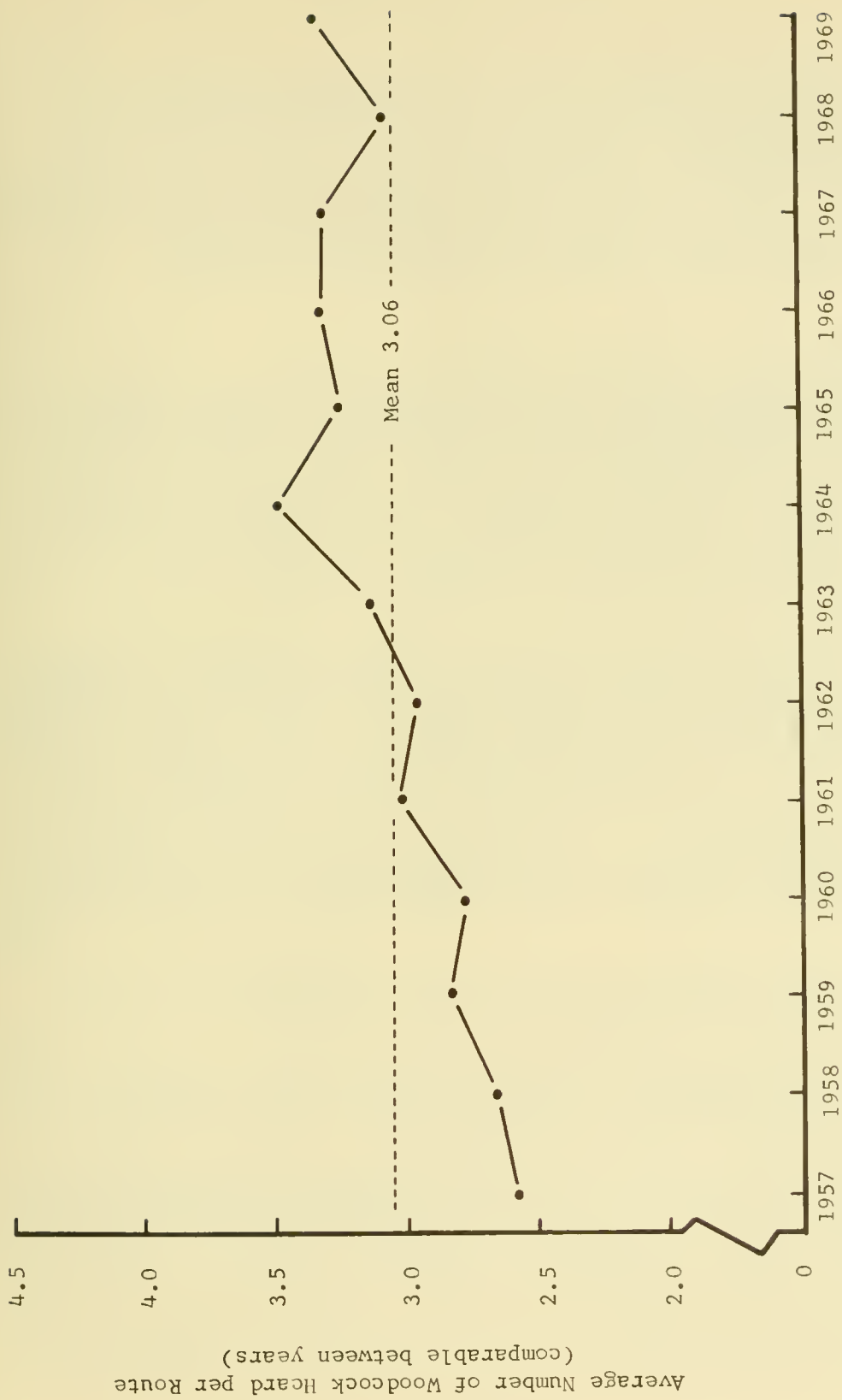


Figure 2.--Trends in singing male woodcock as determined from annual singing-ground surveys
(Base year - 1968)

WING-COLLECTION SURVEY

Dr. William Sheldon, Leader of the Massachusetts Cooperative Wildlife Research Unit, conducted the first woodcock wing-collection survey in New England. The first nationwide survey was initiated by the Bureau in 1959 (Martin, Geis, and Stickel, 1965). Development of currently used techniques for determining woodcock sex (Blankenship, 1957) and age (Martin, 1964) has contributed substantially to the value of this survey as well as to other woodcock research.

Procedures

Wing Collection--Lacking a sampling frame permitting random selection of cooperators, it has been necessary to conduct the wing-collection survey nonrandomly. The mailing lists have included all hunters who responded the previous year, a sample of those who indicated on the mail survey questionnaire of waterfowl hunters that they hunted woodcock, and other hunters who asked to participate or were recommended by fellow hunters. These procedures have weighted the sample too heavily with dedicated woodcock hunters.

An attempt is now being made to obtain a more representative sample of all woodcock hunters. This should produce better information on the annual harvest of the species than is presently obtained. For the 1968-69 survey, six States furnished lists of woodcock hunters randomly selected from their kill surveys. The 2,912 new hunter contacts from these lists represent 40 percent of all contacts in the survey, and 64 percent of the contacts in those six States. Because this is the first year for these hunters, data from wings submitted by them cannot be included in this year's analysis of results from comparable hunters. However, valuable comparisons will be possible next year.

The lists provided by the six States contained from 45 to 1,200 names. A sample of 500 to 600 contacts was considered adequate and longer lists were systematically reduced to that size.

The New Jersey list was composed of hunters who purchased State woodcock hunting stamps in 1966. These stamps were required only during the portion of the woodcock hunting season preceding the general upland game season. The requirement permits a comparison between the response rates of hunters sufficiently interested in woodcock hunting to purchase a special stamp, and of general upland game hunters. The distribution of five categories of participants and the receipts per category are shown in table 3.

To facilitate machine processing, data from the wing-collection survey were coded according to source of the hunter's name, as follows:

- Code 1 - Hunters who contributed wings the preceding year.
- Code 2 - Hunters from the waterfowl mail survey who reported hunting woodcock.
- Code 4 - Hunters who requested participation or were recommended by fellow hunters.
- Code 7 - Hunters who appeared on both Code-1 and Code-9 lists.
- Code 9 - Hunters from the lists provided by the States.

The Station's Electronic Data Processing Section provided a consolidated list of all hunters contacted. Permanent hunter numbers were assigned to facilitate comparison of data from identical hunters in 2 consecutive years. A strip of 11 hunters' identification labels showing name, address, contact code, and hunter number was prepared by machine for each hunter. One label was used in mailing the packet to the hunter; the remainder were enclosed for his use in identifying his 10 wing-collection envelopes. A letter of instructions and a report of the preceding year's survey results completed the packet.

Packets were mailed to hunters 2 to 3 weeks before the opening of the woodcock hunting seasons in each State. Where experience has shown that a significant number of hunters residing in one State hunt in another, the mailing date was keyed to the season in the State where each usually hunted. For example, southern New England packets were mailed approximately 2 weeks prior to opening of the season in Maine where a number of southern New Englanders hunt.

Wing Processing--Wing-collection envelopes were preaddressed to the Migratory Bird Populations Station. As they were received they were sorted by State of hunter's residence, checked for requests for additional envelopes or other external communications, and placed in storage for later examination.

At a work session lasting a week in February 1969, a team of State and Federal biologists processed the wings at the Migratory Bird Populations Station. Sex and age data, as determined by feather characteristics as well as county and State of kill, as reported by the hunter, were coded on the envelopes in which wings were received (fig. 3).

Data Analysis--After this "wingbee," the data were punched on computer cards and later transferred to tape for machine analysis and storage. Since analysis is still in the development stage, considerable programming is required. As systems are perfected and documented, the machine analysis, run on an IBM 360-20 at the Migratory Bird Populations Station, will become routine. Also, more detailed analysis of the data will be possible.

WOODCOCK HUNTERS

We need one wing from each woodcock you kill this season. From these wings we can determine the age and sex of the birds. The ratio of young to old birds tells us how well the breeding population produced young. A report on the findings of this survey will be mailed to hunters who send wings.

PROCEDURE

1. Use ONE envelope for each day's hunt, and enclose ONE wing from each woodcock YOU bag.
2. Do NOT give envelopes to other hunters, and do NOT enclose wings from birds they shoot.
3. Continue sending wings throughout the entire season.
4. Do not wrap wings in foil or plastic as this causes spoilage.
5. Mail as soon as possible — NO POSTAGE REQUIRED. Thank you for your help.

FOR EACH DAY'S HUNT RECORD FOLLOWING: (PLEASE PRINT)	
Date of hunt:	<u>12-17-68</u>
Month Day Year	
Locality(ies) Where Shot:	
Nearest Town(s):	<u>Summerville</u>
County(ies):	<u>Dorchester</u>
State:	<u>S.C.</u>
If banded, list band number(s) here:	
<hr/>	
<hr/>	
Please do not write in this block	
AM	<u>1</u>
AF	<u>1</u>
IM	<u>11</u>
IF	<u>1</u>
AU	
IU	
UU	
Total	<u>5</u>
<u>035</u> <u>80</u>	
WC- 12246	

Form 3-156a
(May 1965)

IF YOU NEED MORE ENVELOPES CHECK HERE

BUDGET BUREAU NO. 42-R:463
APPROVAL EXPIRES MARCH 31, 1970

Figure 3.--Woodcock wing envelope coded and ready for keypunching

Results

The number of nondeliverable packets was relatively low. Although the number from Code-9 hunters (those from the State random lists) was higher than the overall average, 1.7 percent as compared to 1.1 percent, this was not a significant problem. One half of the nondeliverables were returned by Post Office personnel because of address problems, i.e., stamped "Unknown," "Insufficient Address," or other notations. The remaining 42, representing only 0.57 percent of the packets mailed, were returned by the addressee because he was unable to hunt or by the Post Office because the addressee had moved.

Hunter response to the wing-collection survey has been very good every year since its inception. Wing receipts have varied from 8,786 the first year to 18,448 in the 1968-69 season, with an average of over 13,000 per season. Table 4 provides a listing, by State, of the number of cooperators and the envelopes and wings received during the past three hunting seasons. The number of envelopes is included because each represents one day's hunt by one hunter.

Comparison of Sample Source--Table 5 lists response rate and wings contributed by participants in the three principal categories of hunters. Code-4 is not included because the sample is small, and contributions by hunters in this category do not represent the full season because they were added during the season. Data from Code-7 hunters are included with both Code-1 and Code-9 since they are hunters who originally appeared on both lists.

Response rate and number of wings per respondent vary markedly between hunters from different sample sources. By definition, Code-1 hunters rate much higher than others in these respects since they responded the previous year and nonrespondents have already been eliminated from their ranks. Also, those who remain on the list year after year tend to be veteran hunters who harvest more birds throughout the season.

Response was substantially lower from Code-9 hunters (State Game Kill Survey lists) than from Code-2 hunters (Bureau waterfowl mail survey), except in New Jersey where they were from a list of special woodcock hunting stamp purchasers. The combined weighted averages in table 5 do not include New Jersey data in Code-9 due to the noncomparability.

Table 6 further illustrates variability in data from hunters belonging to different code categories. Comparison of Code-9 percent of hunter contacts with Code-9 percent of wings submitted shows extreme variability between States. The figures for New Jersey are particularly striking.

Because of the management implications involved, the percentages of the kill occurring during the first week of the season and immature per adult female ratios were calculated by code categories. Although these are sketchy one-season data, they suggest differences between results from different sample sources.

Only Maine and Michigan provided enough data for statistical analysis of the proportion of kill occurring during the first week of the season. In those States, kill by Code-9 hunters (State Game Kill Survey lists) was concentrated in the first week of the season much more than kill by other hunters.

Comparison of age ratios by sample source was less definitive. Age ratio data were subjected to chi-square tests of homogeneity with the following results:

Maine:	$\chi^2 = 2.4555$	(P<.30>.20)
Michigan:	$\chi^2 = 2.6227$	(P<.30>.20)
New Jersey:	$\chi^2 = 0.2867$	(P<.90>.80)
New York:	$\chi^2 = 1.2344$	(P<.70>.50)
Wisconsin:	$\chi^2 = 3.9351$	(P<.20>.10)

Results further demonstrate noncomparability of the New Jersey list with those of other States. Although the data are inconclusive on this point, there are indications that sample source may bias age ratios of samples in some States.

If the two sexes and the two age groups migrate at different times, the source from which the hunter's name was obtained will strongly influence survey data on harvest rates and age ratios. If the proportion of hunters from different sources is materially changed, it will be necessary to include both old and new methods for 1 or more years to provide continuity of indexes.

The variability between the kill surveys of various States, as indicated by our State random lists, is evidence of the need for a uniform sampling framework such as that provided in the proposed Federal migratory upland game bird hunting stamp.^{1/}

^{1/} H.R. 5510, 91st Congress - a bill "To require a Federal permit for the taking of any migratory game birds other than migratory waterfowl, and for other purposes."

Weighting Factors--Since wings received from each State were not always proportional to the woodcock harvest in that State, it was necessary to apply weighting factors to data used in computing overall productivity and harvest figures to show index trends.

Because we lack a uniform nationwide sampling frame for woodcock hunters, a completely satisfactory weighting method has not been devised. The system used in the analysis of the 1967-68 hunting season data (Clark in Goudy, 1969) was applied to the 1963-69 data. Briefly, this is based on State woodcock kill figures obtained from the Bureau's Waterfowl Mail Survey, which samples waterfowl hunters only. However, the sample is biased by variations among States in the proportion of their hunters who hunt waterfowl. For example, there is a wide disparity between Louisiana, where nearly one-third of the licensed hunters hunt waterfowl, and Pennsylvania, where the ratio of licensed hunters to stamp purchasers is over 20 to 1. The Bureau's waterfowl Mail Survey figures for woodcock are adjusted accordingly to provide a "kill index" figure for each State. Data are weighted proportionally.

As a minor modification in weighting factors derived for this report, the ratio of license holders to stamp purchasers was the mean of the 2 most recent years rather than the figure for the latest year. Likewise, the woodcock kill by duck stamp purchasers was the mean of the 2 most recent years. Derivation of weighting factors for the wing-collection survey is shown in table 7.

Admittedly the weighting procedure is crude. One of the greatest sources of error stems from the inclusion of substantial numbers of those who hunt only big game in the State license totals. This inflates weighting factors for States with high deer populations and relatively few waterfowl hunters. But, in most States, results of weighting by the present method are more consonant with State game kill figures and the response in the wing-collection survey than when data are weighted by previous methods. Again the need for a uniform sampling frame is demonstrated.

Productivity Index--The age ratio expressed as the number of immatures per adult female is considered to be the index to the woodcock's productivity rate as measured by this survey. Rough age ratio figures for States represented by at least 100 wings are shown in table 8. Although rates shown in that table are based on larger samples, (all wings in the survey except a few from special areas or lacking essential data), they are less comparable between years than those shown in table 9. In the latter table, only wings from hunters who participated both seasons are used for the index comparison. This eliminates a major source of variability, the difference between hunting habits of hunters in various contact groups.

Changes in productivity are not shown for each State in table 9 because they may be influenced by different times of migration induced by weather, hunting season restrictions, or other local factors. These influences are believed to be somewhat compensating when data for all States are combined. Also, since the comparable hunter list changes from year to year, the weighted age ratio for a particular year as shown in one report may differ from the ratio shown for that year in the preceding report. Consequently, this is used as an index only--the annual percent change is the significant figure.

From the beginning of the wing-collection survey in 1959, annual changes in the productivity index have fluctuated between -8.75 percent in 1965 and +7.43 percent in 1961. By applying annual percent changes to the 1967 base year, a curve was developed which shows productivity above the 10-year mean the first 6 years of the period and below the mean the last 4 years (fig. 4). The increase of 5.36 percent in 1968-69 was the first noticeable improvement since 1961-62. The overall downward trend in the productivity index is in contrast to the upward trend in the breeding population index over the same period. An explanation of the divergence is not apparent, but it suggests that further refinement of one or both surveys is needed.

Hunter Success Index--The number of woodcock wings contributed, per successful hunting day and per season, by hunters participating in both the current and preceding seasons, has been used as an index of hunter success. A major source of bias has been removed by restricting the comparison to comparable hunters. However, in years when regulations change, changes in hunter success must be at least partially related to the regulations rather than to woodcock abundance. This is demonstrated in figure 4 where the sharp increases in hunter success for the seasons of 1964-65 and 1967-68 coincide with increases in season length of 10 and 15 days respectively.

Annual changes in daily harvest have been slight since the 1963-64 season, even though the daily bag was raised from four to five birds in that season. The trend in average daily bag was downward from 1963 to 1966 but increased 2.6 percent in 1967-68, and further increased 3.8 percent in 1968-69. The seasonal harvest has shown greater annual fluctuations but the general trend has been upward, largely coincident with liberalized regulations (fig. 4). The change from 1967-68 to 1968-69 was very slight.

RANGEWIDE HARVEST

The migratory game bird harvest survey in Canada conducted by the Canadian Wildlife Service uses migratory game bird hunting permit records

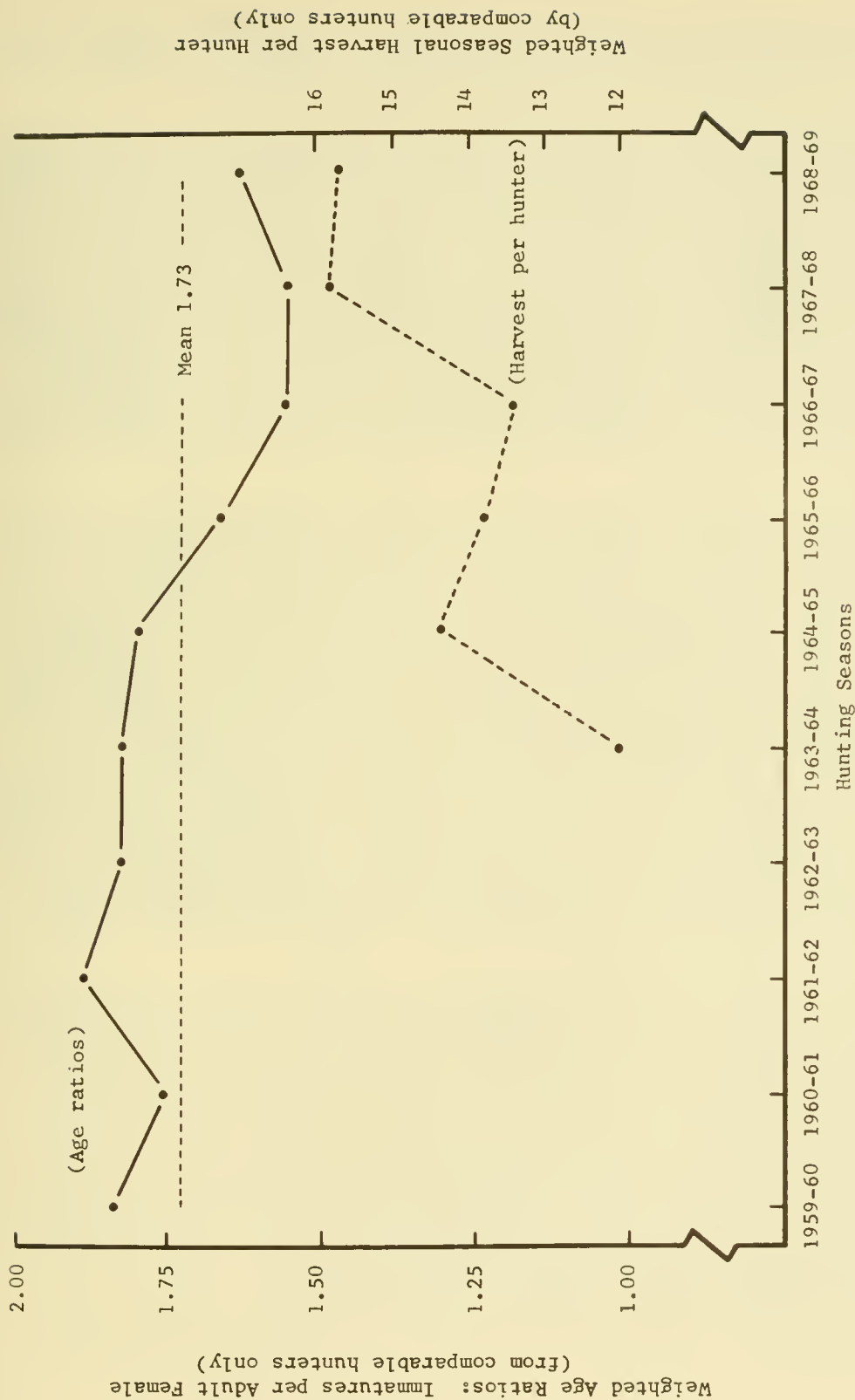


Figure 4.--Weighted age ratios and seasonal harvest per hunter as determined from annual woodcock wing-collection surveys

as a sampling frame. This survey indicated a harvest of approximately 100,000 woodcock in the 1968-69 season, an increase of 10 percent over 1967-68, the first year of the survey (Benson, 1969).

Lacking a uniform sampling frame in the United States, harvest estimates are based on available State kill surveys and to some degree on results from the Bureau's annual waterfowl mail questionnaire survey. The latter includes questions on the number of woodcock harvested by the hunter. These data can be expanded to provide an estimate of the harvest by those who purchase duck stamps. Considering the variability of procedures in the State kill surveys, the absence of surveys in some States, and the limitations of the waterfowl mail questionnaire survey (nonwaterfowl hunters are not sampled although they outnumber waterfowl hunters nearly 8 to 1 in the 13 States with the heaviest woodcock harvest), the U.S. kill figure is at best a guess-estimate. The best evidence available indicates a U.S. harvest of about 1 million woodcock in the 1968-69 season.

Trends in State woodcock harvests appear to be generally upward, especially in northern States. The kills according to State surveys in four States reporting a substantial harvest and contributing large numbers of wings to the survey were graphed (fig. 5). Some of the annual changes may reflect local conditions. For example, the sharp drop in the Maine harvest in 1963 may be explained by curtailment of the hunting season because of extreme forest fire hazard (Peppard in Goudy, 1967). Although the rising trend in harvest conceivably could be partially attributed to relaxed regulations, the results of the relaxation have been variable. For many northern hunters the effective woodcock hunting season is from beginning of leaf fall to end of migration. The 40-day season in effect through 1962-63 coincided with that period quite well. Frequently the migration is over before the open season ends. Although some northern States provided longer hunting periods by advancing opening dates, in others the effective season changed but little (table 11).

Opening dates of 1968-69 woodcock hunting seasons are shown in figure 6 (Federal Regulatory Announcement No. 80 issued August 1968). It appears that these seasons in northern States generally are keyed to the period beginning just prior to leaf fall and ending with the conclusion of migration. Seasons in southern States are generally coordinated with the period of greatest abundance of wintering migrants. In the intermediate latitudes where hunting opportunity is largely dependent upon migrating birds, it is more difficult to select the most advantageous seasons. However, with longer seasons now available it is possible in some cases to further improve hunting opportunity by adjusting the season to the presence of birds.

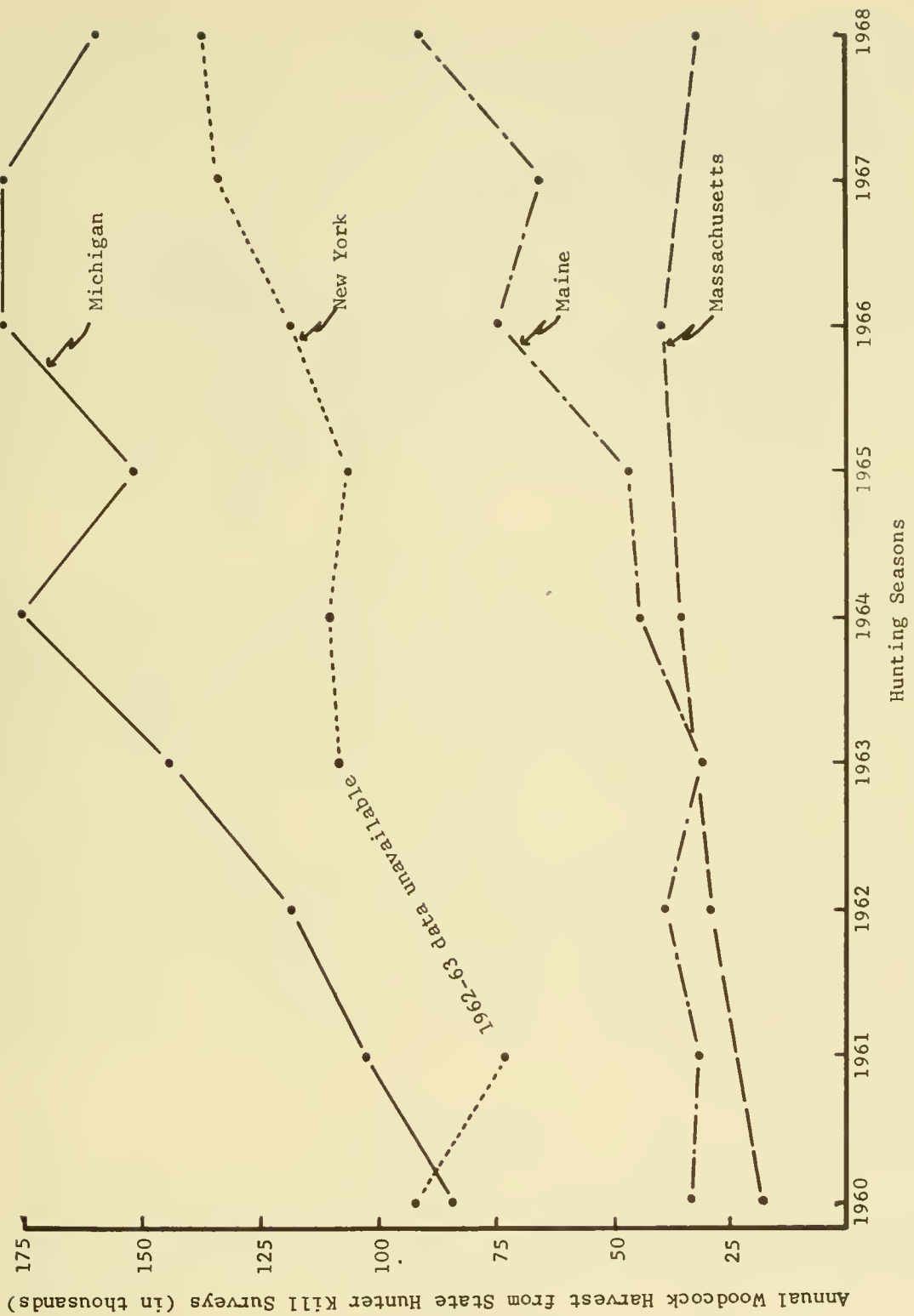


Figure 5.--Trends in woodcock harvests in four important northern hunting States

Sheldon (1967) presents substantial data on the chronology of woodcock migrations. In Michigan only 19 of 1,725 wings in the 1968-69 survey were taken after November 3. This suggests that woodcock had migrated from southern Michigan by that date. The migration appeared to be slightly later in New York but only 17 of 1,576 wings from that State, exclusive of Long Island and coastal counties, were taken after November 9. Glasgow (1958) states "Migratory woodcock begin to arrive in Louisiana in October and gradually increase in number to about November 20, after which there is a noticeable acceleration in the number arriving. However, the wintering population does not reach a peak until about December 12-15. These arrival dates vary somewhat with weather conditions to the north of Louisiana but seldom by more than a week or 10 days." The evidence that most migrants have departed from the northern States by early November and that many arrive on the wintering grounds between October and mid-December suggests that the intermediate latitude States opening their season in mid-November or later may be missing a substantial portion of the migrant woodcock available for hunting.

RESEARCH STATUS

In the first 2 years of the Accelerated Research for Migratory Upland Game Birds (July 1, 1967 through June 30, 1969), much of the study on woodcock was directed toward establishment of randomly selected singing-ground survey routes. With route randomization nearing completion in mid-1969 emphasis shifted to breeding ground banding and research on specific problems. Much more effort is needed on banding, coincident with perfection of capture techniques.

Although banding on breeding grounds is being emphasized, much more banding on wintering grounds and migration routes is needed. Probably there are few opportunities for productive banding of migrant woodcock but every possibility should be explored. A prime example is the concentration that occurs in the fall at Cape May, New Jersey. A crew of two to five biologists banded 644 woodcock there in 12 nights in 1968. Wintering ground banding is particularly needed in the South Atlantic and Eastern Gulf States. Table 12 lists research projects now in progress.

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APPENDIX

Table 1.--Woodcock breeding population indexes as indicated by singing-ground surveys in 1968 and 1969

State or Province	Total Routes Conducted				Comparable Routes	Woodcock per Comparable Rt.	
	Non-random 1968	1969	Random 1968	1969		1968	1969.
<u>EASTERN REGION</u>							
Connecticut*	12	13	0	11	9	3.22	2.11
Delaware**	0	0	3	3	2	1.00	0.50
Maine**							
Management	34	32	--	--	24	9.33	8.17
Random	--	--	55	59	39	3.41	3.85
Maryland**	0	0	23	22	17	1.82	2.53
Massachusetts*	8	8	0	19	6	7.00	6.83
New Brunswick*	10	4	0	24	2	8.00	7.50
New Hampshire*	12	9	0	16	9	7.22	6.44
New Jersey**	0	0	16	12	10	1.70	1.60
New York**	0	0	94	82	64	3.44	3.70
North Carolina**	0	0	59	52	34	0.29	0.06
Nova Scotia**	7	0	23	21	8	3.75	2.38
Pennsylvania**	0	0	73	74	47	1.45	1.26
Prince Edward Island*	3	0	0	11	0	--	--
Rhode Island*	0	0	0	4	0	--	--
Vermont*	5	5	0	22	4	6.25	7.75
Virginia*	0	0	0	80	0	--	--
REGIONAL TOTALS & WEIGHTED AVGS.***							
	91	71	346	512	275	3.17	3.30
PERCENT CHANGE IN WOODCOCK HEARD FROM 1968							+ 4.22
<u>WESTERN REGION</u>							
Illinois	4	4	0	0	2	3.00	1.50
Indiana**	4	0	60	60	34	1.32	0.82
Iowa	12	10	0	0	4	2.00	1.00
Michigan**	0	0	135	135	98	4.29	4.12
Minnesota*	17	10	0	59	5	6.20	8.20
Ohio	11	12	0	0	4	4.50	6.25
Ontario**	0	0	88	72	40	4.28	5.72
West Virginia**	0	0	54	50	45	0.76	1.07
Wisconsin**	7	4	97	116	61	2.11	2.16
REGIONAL TOTALS & WEIGHTED AVGS.***							
	55	40	434	492	293	3.03	3.40
PERCENT CHANGE IN WOODCOCK HEARD FROM 1968							+ 12.14
<u>RANGEWIDE TOTALS</u>							
& WEIGHTED AVGS.***	146	111	780	1004	568	3.09	3.36
PERCENT CHANGE IN WOODCOCK HEARD FROM 1968							+8.82

* In the process of changing to randomly selected routes in 1969.

** Randomly selected routes conducted in both 1968 and 1969.

***Weighted indexes are obtained by multiplying woodcock heard per comparable route with a factor based on land area in those States or Provinces where one comparable route represented not more than 2,000 square miles.

Table 2.--Weight factor derivation - 1969 woodcock singing-ground survey

State or Province	Land Area (Sq. Mi.)	Comparable Routes	Sq. Mi./Rt.	Regional Weight	Rangewide Weight
<u>EASTERN REGION</u>					
Connecticut	4,351*	9	483	.0247	.0101
Delaware	1,978	2	989	.0112	.0046
Maine	33,215	39	852	.1884	.0769
Maryland	10,577	17	622	.0600	.0245
Massachusetts	7,170*	6	1,195	.0407	.0166
New Brunswick	26,099*	2	13,050	--	--
New Hampshire	8,537*	9	949	.0484	.0198
New Jersey	7,836	10	784	.0444	.0181
New York	49,576	64	775	.2812	.1148
North Carolina	52,712	34	1,550	--	--
Nova Scotia	21,068	8	2,489	--	--
Pennsylvania	45,333	47	965	.2571	.1050
Prince Edward Island	2,184	0	--	--	--
Rhode Island	1,214	0	--	--	--
Vermont	7,742*	4	1,936	.0439	.0179
Virginia	40,815	0	--	--	--
REGIONAL TOTALS	176,315**			.9999	
<u>WESTERN REGION</u>					
Illinois	18,496*	2	9,248	--	--
Indiana	36,291	34	1,067	.1420	.0840
Iowa (3 counties)	2,105	4	526	.0082	.0098
Michigan	58,216	98	594	.2278	.1348
Minnesota	17,133*	5	3,427	--	--
Ohio	21,852*	4	5,463	--	--
Ontario	78,570***	40	1,964	.3075	.1819
West Virginia	24,181	45	537	.0946	.0560
Wisconsin	56,154	61	921	.2198	.1300
REGIONAL TOTALS	255,517**			.9999	
RANGEWIDE TOTALS	431,832**				.9999

* Comparable routes are non-random - figure is uncultivated land area as used in previous years.

** Excluding those States and Provinces for which no figure shown in weight columns.

*** Area of that portion covered by survey only.

(Those States and Provinces represented by at least 10 comparable routes or where each comparable route represents not more than 2000 sq. mi. and having at least 0.5 woodcock per comparable route are included in the weighting.)

Table 3.--Distribution of participants and wings received per participant in 1968-69 woodcock wing-collection survey

State of residence	Contact code*					Hunters contacted**	Wings received***	Wings per contact
	1	2	4	7	9			
Ala.	6	31				37	48	1.3
Ark.	3	24				27	14	0.5
Conn.	113	199	2			314	931	3.0
Del.	8	32				40	36	0.9
D.C.	1					1	0	-
Fla.	9	28	1			38	16	0.4
Ga.	17	58				75	50	0.7
Ill.	13	58				71	99	1.4
Ind.	17	60			45	122	198	1.6
Iowa	1	14				15	0	-
Kans.	1	10				11	0	-
Ky.	3	8				11	2	0.2
La.	52	70				122	444	3.6
Maine	137	188	8	7	545	885	2941	3.3
Md.	19	42				61	149	2.4
Mass.	115	237	4			356	1573	4.4
Mich.	131	214	2		635	982	1768	1.8
Minn.	36	51	1			88	279	3.2
Miss.	6	61	1			68	68	1.0
Mo.	11	35	2			48	13	0.3
Nebr.		2				2	0	-
N.H.	79	136	3			218	855	3.9
N.J.	87	183	4	32	537	843	2622	3.1
N.Y.	176	96	1	6	620	899	1976	2.2
N.C.	22	77				99	80	0.8
Ohio	77	162	1			240	648	2.7
Okla.		11				11	0	-
Pa.	129	205	7			341	1381	4.0
R.I.	26	36	2			64	216	3.4
S.C.	18	34				52	55	1.1
S. Dak.		4				4	0	-
Tenn.	1	21				22	2	0.1
Tex.	8	13				21	43	2.0
Vt.	41	59				100	545	5.4
Va.	18	70	2			90	45	0.5
W. Va.	12	35	1			48	99	2.1
Wis.	104	182	2	2	530	820	1047	1.3
TOTALS	1497	2746	44	47	2912	7246	18243	2.5

* Code 1 - Submitted wings the previous year.

Code 2 - Hunters on waterfowl mail survey who reported hunting woodcock.

Code 4 - Requested participation or proposed by fellow hunter.

Code 7 - Appeared on both Code 1 and Code 9 lists.

Code 9 - From list provided by State from its kill survey (except in New Jersey, where list was from woodcock hunting stamp purchasers).

**Excluding nondeliverable packets.

***Excluding wings with incomplete data or from Special Study areas.

Table 4.--Data from woodcock wing-collection surveys conducted during the 1966-67, 1967-68, and 1968-69 hunting seasons

State of residence	Number of cooperators			Number of envelopes			Number of wings			Avg. no. of wings per envelope			Avg. no. of wings per cooperator		
	66-67	67-68	68-69	66-67	67-68	68-69	66-67	67-68	68-69	66-67	67-68	68-69	66-67	67-68	68-69
	1	6	8	1	26	23	1	53	48	--	--	--	--	--	--
Ala.	4	3	5	15	8	10	28	11	14	--	--	--	--	--	--
Ark.	65	113	130	222	316	419	487	633	931	2.2	2.0	2.2	7.5	5.6	7.2
Conn.	11	8	9	15	12	22	25	16	36	--	--	--	--	--	--
Del.	0	1	0	0	2	0	0	4	0	--	--	--	--	--	--
D.C.	5	9	5	25	15	11	84	31	16	--	--	--	--	--	--
Fla.	8	18	20	14	24	40	27	25	50	--	--	--	--	--	--
Ga.	6	13	9	20	33	43	31	34	99	--	--	--	--	--	--
Ill.	18	17	26	39	58	79	104	129	198	2.7	2.2	2.5	5.8	7.6	7.6
Ind.	1	1	0	1	1	0	3	0	0	--	--	--	--	--	--
Iowa	4	3	2	9	4	2	14	5	2	--	--	--	--	--	--
Ky.	34	52	32	136	161	157	382	370	444	2.8	2.3	2.8	11.2	7.1	13.9
La.	110	145	253	627	700	1049	1980	1803	2941	3.2	2.6	2.8	18.0	12.4	11.6
Maine	14	21	9	38	67	57	86	140	149	2.3	2.1	2.6	6.1	6.7	16.6
Md.	78	117	128	329	529	557	914	1473	1573	2.8	2.8	2.8	11.7	12.6	12.3
Mass.	130	132	195	491	561	716	1215	1402	1768	2.5	2.5	2.5	9.3	10.6	9.1
Mich.	31	36	35	96	126	113	324	390	279	3.4	3.1	2.5	10.5	10.8	8.0
Minn.	2	6	10	6	12	29	18	23	68	--	--	--	--	--	--
Miss.	8	11	5	17	15	7	24	18	13	--	--	--	--	--	--
Mo.	50	80	80	174	282	353	400	599	855	2.3	2.1	2.4	8.0	7.5	10.7
N.H.	90	119	273	373	488	1032	1059	1186	2622	2.8	2.4	2.5	11.8	10.0	9.6
N.J.	109	185	236	446	739	800	1175	1864	1976	2.6	2.5	2.5	10.8	10.1	8.4
N.Y.	8	23	24	15	47	55	21	68	80	--	--	--	--	--	--
N.C.	61	78	71	196	243	251	512	613	648	2.6	2.5	2.6	8.4	7.9	9.1
Ohio	113	131	157	342	492	556	818	1211	1381	2.4	2.5	2.5	7.2	9.2	8.8
Pa.	18	26	25	69	97	85	136	257	216	2.0	2.6	2.5	7.6	9.9	8.6
R.I.	8	18	11	14	34	24	19	48	55	--	--	--	--	--	--
S.C.	35	28	1	40	31	2	73	36	2	--	--	--	--	--	--
Tenn.	4	8	5	4	22	20	4	34	43	--	--	--	--	--	--
Tex.	36	41	47	146	268	242	317	694	545	2.2	2.6	2.3	8.8	16.9	11.6
Vt.	12	18	14	22	41	25	41	67	45	--	--	--	--	--	--
Va.	14	13	15	29	45	41	63	105	99	2.2	2.3	2.4	4.5	8.1	6.6
W. Va.	97	107	164	270	326	465	704	747	1047	2.6	2.3	2.3	7.3	7.0	6.4
Wis.	--	--	--	--	--	--	2008	1785	196	--	--	--	--	--	--
Other	1185	1587	2004	4241	5825	7285	13097	15874	18439	2.6*	2.4*	2.5*	9.4*	8.9*	9.1*
TOTALS	1185	1587	2004	4241	5825	7285	13097	15874	18439	2.6*	2.4*	2.5*	9.4*	8.9*	9.1*

* Unweighted mean (includes data from all States, but excludes information from the special study areas and Canadian Provinces).

Table 5.--Comparison of hunters and rate of wings received for principal code categories

State of Residence	No. of Contacts			No. Responding			No. of Wings			% Responding			Wings/Contact			Wings/Contributor		
	1	2	9	1	2	9	1	2	9	1	2	9	1	2	9	1	2	9
Ala.	6	31		3	5		34	14		50	16		5.7	.5		11.3	2.8	
Ark.	3	24		3	2		11	3		100	8		3.7	.1		3.7	1.5	
Conn.	113	199		66	59		629	296		58	30		5.6	1.5		9.5	5.0	
Del.	8	32		3	3		6	20		38	9		.8	.6		2.0	6.7	
D. C.	1	--		0	--		--	--		0	--		--	--		--	--	
Fla.	9	28		0	5		--	16		0	18		--	.6		--	3.2	
Ga.	17	58		9	11		22	28		53	19		1.3	.5		2.4	2.5	
Ill.	13	58		5	4		86	13		38	7		6.6	.2		17.2	3.2	
Ind.	17	60	45	13	11	2	150	41		76	18	4	8.8	.7	.2	11.5	3.7	3.5
Iowa	1	14		0	0		--	--		0	0		--	--		--	--	
Kans.	1	10		0	1		--	--		0	10		--	--		--	--	
Ky.	3	8		1	1		1	1		33	12		.3	.1		1.0	1.0	
La.	52	70		25	5		410	27		48	7		7.9	.4		16.4	5.4	
Maine	144	188	552	95	47	98	1725	333	730	66	25	18	12.0	1.8	1.3	18.2	7.1	7.4
Md.	19	42		5	3		112	37		26	7		5.9	.9		22.4	12.3	
Mass.	115	237		73	45		1261	269		63	19		11.0	1.1		17.3	6.0	
Mich.	131	214	635	74	38	56	1136	169	197	56	18	9	8.7	.8	.3	15.3	4.4	3.5
Minn.	36	51		25	9		258	20		69	18		7.2	.4		10.3	2.2	
Miss.	6	61		1	9		1	67		17	15		.2	1.1		1.0	7.4	
Mo.	11	35		3	3		5	13		27	9		.5	.4		1.7	4.3	
Nebr.	--	2		--	0		--	--		--	0		--	--		--	--	
N.H.	79	136		47	22		652	127		59	16		8.3	.9		13.9	5.8	
N.J.	119	183	569	87	36	157	1112	151	1677	73	20	28	9.3	.8	2.9	12.8	4.2	10.7
N.Y.	182	96	626	112	24	97	1403	108	430	62	25	15	7.7	1.1	.7	12.5	4.5	4.4
N.C.	22	77		8	16		19	80		36	21		.9	1.0		2.4	5.0	
Ohio	77	162		45	21		511	105		58	13		6.6	.6		11.4	5.0	
Okla.	--	11		--	0		--	--		--	0		--	--		--	--	
Pa.	129	205		95	49		1142	182		74	24		8.8	.9		12.0	3.7	
R.I.	26	36		13	8		159	23		50	22		6.1	.6		12.2	2.9	
S.C.	18	34		9	2		45	10		50	6		2.5	.3		5.0	5.0	
S. Dak.	--	4		--	0		--	--		--	0		--	--		--	--	
Tenn.	1	21		0	1		--	2		0	5		--	.1		--	2.0	
Tex.	8	13		3	1		38	4		38	8		4.8	.3		12.7	4.0	
Vt.	41	59		29	16		435	83		71	27		10.6	1.4		15.0	5.2	
Va.	18	70		5	4		27	9		28	6		1.5	.1		5.2	2.2	
W. Va.	12	35		8	4		47	23		67	11		3.9	.7		5.9	5.8	
Wis.	106	182	532	63	21	80	690	57	258	61	12	15	6.5	.3	.5	11.0	2.7	3.2
TOTALS and Wtd. Avgs.	1544	2746	2959	928	486	490	12127	2331	3299	61.1	18.4	13.9	8.0	0.9	0.7	13.2	4.8	4.9

Table 6.--Comparison of Code-9* data with those from other codes in five States

	Maine	Michigan	New Jersey	New York	Wisconsin
Hunter Contacts					
State Total**	877	980	839	898	818
Code 9*	545	634	537	620	530
Code 9 Percent of Total	62.1	64.8	64.0	69.0	64.8
Wings Submitted					
State Total**	2670	1502	2507	1927	998
Code 9*	612	197	1244	412	251
Code 9 Percent of Total	22.9	13.1	49.6	21.4	25.2
First Week of Season Wings***					
Code 1*					
Number	199	220	46	47	12
Percent of Season Total	12.2	20.1	9.2	3.7	1.8
Code 2*					
Number	66	37	13	1	8
Percent of Season Total	20.4	21.9	13.0	1.0	14.0
Code 9*					
Number	122	58	144	14	6
Percent of Season Total	18.1	29.4	11.7	3.3	2.4
State Total**					
Number	396	315	239	62	26
Percent of Season Total	15.1	21.6	11.2	3.5	2.6
Immature/Adult Female Ratio					
Code 1*					
Immatures	910	552	520	592	300
Imm./Ad. Female	2.26	1.59	2.32	1.48	1.46
Code 2*					
Immatures	160	87	54	42	33
Imm./Ad. Female	1.93	1.74	2.57	1.45	2.20
Code 9*					
Immatures	383	86	916	214	106
Imm./Ad. Female	1.95	1.23	2.43	1.70	1.16
State Total**					
Immatures	1383	725	1249	841	437
Imm./Ad. Female	2.12	1.55	2.46	1.52	1.40

* Code 1 - Submitted wings the previous year.

Code 2 - Hunters on waterfowl mail survey who reported hunting woodcock.

Code 9 - From list provided by State from its kill survey (except New Jersey, where list was from woodcock hunting stamp purchasers).

(Note: Code 7-figures are included with both Code-1 and Code-9 results.)

** Excluding Code 4.

***Six days in Maine and New Jersey (Sunday hunting prohibited); seven days in Michigan, New York, and Wisconsin.

Table 7.--Derivation of weighting factors - woodcock wing-collection survey

A	B	C	D	E	F	G	H	J	K	L	M
	Hunting License Holders	Duck Stamp Sales	Woodcock Kill by Duck Stamp Purchasers	License Holders to Stamp Sales Ratio	Percent of Mean	State Kill Index	State Weight Factor				
State*	1966-67	1967-68	1966-67	1967-68	1966-67	1967-68	1966-67	1967-68	Mean		
Conn.	66,680	71,915	9,330	9,479	13,145	12,277	7,1468	7,5867	7.3667	65.66	8,346 .0252
La.	299,581	317,737	104,680	108,682	54,782	66,219	2,8619	2,9235	2.8927	25.78	15,597 .0472
Maine	200,277	203,284	13,330	13,223	25,390	27,845	15,0245	15,3735	15.1990	135.47	36,059 .1091
Mass.	117,389	138,015	22,240	21,119	25,044	20,837	5,2783	6,5351	5.9067	52.64	12,076 .0365
Mich.	912,275	903,545	84,240	95,187	68,813	73,866	10,8295	9,4923	10.1609	90.56	64,606 .1954
Minn.	464,816	473,402	150,070	157,937	10,027	17,100	3,0973	2,9974	3.0473	27.16	3,684 .0111
N.H.	85,495	93,146	6,450	6,726	9,491	8,232	13,2550	13,8486	13.5518	120.79	10,704 .0324
N.J.	168,643	181,871	26,320	28,935	14,299	20,916	6,4074	6,2855	6.3464	56.56	9,958 .0301
N.Y.	746,692	731,601	65,860	77,586	49,468	77,397	11,3376	9,4295	10.3835	92.55	58,708 .1776
Ohio	573,328	490,223	30,400	30,175	9,880	10,211	18,8595	16,2459	17.5527	156.45	15,717 .0475
Pa.	995,190	1,062,121	42,810	52,084	18,682	40,383	23,2467	20,3924	21.8195	194.48	57,434 .1737
Vt.	135,774	144,689	4,980	5,725	7,188	9,151	27,2639	25,2731	26.2685	234.13	19,129 .0579
Wis.	571,058	597,119	107,570	110,479	36,246	41,597	5,3081	5,4048	5.3564	47.74	18,581 .0562

*Thirteen States having substantial woodcock harvests and adequately represented in wing-collection survey.

$$\frac{A}{C} = G \qquad \frac{B}{D} = H \qquad \frac{G+H}{2} = J \qquad \frac{J}{\Sigma J/13} = K \qquad \frac{K(E+F)}{2} = L \qquad \frac{L}{\Sigma L} = M$$

Table 8.--Sex-Age distribution of wings in the woodcock wing-collection survey; 1968-69 hunting season

State or Province of harvest	Age and Sex Categories							Total wings received	Immatures per adult female*
	Adult		Immature		Unknown				
	male	female	unknown	male	female	unknown	age		
Alabama	11	14	2	6	6	1	2	42	--
Arkansas	8	4	0	4	2	0	0	18	--
Connecticut	113	131	6	195	177	6	23	651	2.89
Delaware	4	3	0	11	3	1	0	22	--
Florida	7	3	1	4	3	0	0	18	--
Georgia	16	16	0	7	11	0	1	51	--
Illinois	3	2	0	4	4	0	0	13	--
Indiana	16	44	0	27	31	1	1	120	1.34
Kentucky	0	1	0	0	1	0	0	2	--
Louisiana	57	98	5	147	156	8	10	481	3.17
Maine	671	860	36	836	886	27	79	3,395	2.03
Maryland	18	29	3	46	26	4	2	128	2.62
Massachusetts	126	210	7	201	180	2	9	735	1.82
Michigan	367	624	31	470	468	9	60	2,029	1.52
Minnesota	28	91	6	56	53	5	3	242	1.25
Mississippi	13	31	2	19	15	1	2	83	--
Missouri	5	0	0	6	1	1	0	13	--
New Brunswick	36	33	1	36	49	1	7	163	2.61
New Hampshire	336	422	10	348	330	6	26	1,478	1.62
New Jersey	360	533	17	677	637	21	47	2,292	2.50
New York	391	663	21	543	469	16	54	2,157	1.55
North Carolina	12	17	0	27	11	1	0	68	--
Ohio	75	116	9	133	119	12	27	491	2.28
Ontario	0	0	0	0	1	0	0	1	--
Pennsylvania	318	459	15	316	266	17	47	1,438	1.31
Quebec	0	1	1	1	3	0	0	6	--
Rhode Island	11	7	1	45	39	3	6	112	12.43
South Carolina	16	31	0	30	37	5	0	119	2.32
Tennessee	11	9	0	11	4	0	1	36	--
Texas	17	9	2	6	3	0	2	39	--
Vermont	117	191	3	175	168	3	9	666	1.81
Virginia	5	4	1	14	15	2	1	42	--
West Virginia	16	15	1	14	18	2	8	74	--
Wisconsin	234	353	18	252	237	10	19	1,123	1.41
TOTALS	3,418	5,024	199	4,667	4,429	165	446	18,348	1.84

*Unweighted data from harvest areas represented by at least 100 wings.

Table 9.--Indexes of woodcock productivity as indicated by age ratios determined from wings received from cooperators participating in both 1967-68 and 1968-69 wing-collection surveys

Area of harvest	Weighting factor	Number of wings received		Adult Females		Immatures		Immatures per adult female*		Change in weighted age ratios
		1967-68	1968-69	1967-68	1968-69	1967-68	1968-69	1967-68	1968-69	
Alabama		48	34	5	9	26	11	--	--	
Arkansas		12	15	3	3	6	5	--	--	
Connecticut**	.0252	343	418	61	86	208	248	3.41	2.88	
Delaware		10	6	1	0	8	4	--	--	
Georgia		14	20	1	7	9	7	--	--	
Illinois		2	9	1	2	0	6	--	--	
Indiana		85	89	28	35	38	41	--	--	
Kentucky		2	1	0	1	2	0	--	--	
Louisiana**	.0472	249	427	57	86	158	293	2.77	3.41	
Maine**	.1091	1893	2016	539	496	875	1061	1.62	2.14	
Maryland		48	92	13	24	22	51	--	--	
Massachusetts**	.0365	520	522	148	145	277	287	1.87	1.98	
Michigan**	.1954	1336	1280	447	414	580	632	1.30	1.53	
Minnesota**	.0111	234	213	68	82	119	107	1.75	1.30	
Mississippi		6	2	1	1	2	1	--	--	
Missouri		8	5	2	0	5	3	--	--	
New Brunswick		164	116	38	22	99	57	--	--	
New Hampshire**	.0324	911	1126	313	310	382	517	1.22	1.67	
New Jersey**	.0301	720	891	168	224	384	523	2.29	2.33	
New York**	.1776	1667	1425	471	443	814	674	1.73	1.52	
North Carolina		16	19	6	5	5	13	--	--	
Ohio**	.0475	398	376	114	84	185	202	1.62	2.40	
Pennsylvania**	.1737	1097	1113	337	358	471	454	1.40	1.27	
Quebec		8	6	4	1	4	4	--	--	
Rhode Island		38	46	6	5	23	33	--	--	
South Carolina		24	88	5	24	15	53	--	--	
Texas		8	34	5	7	1	8	--	--	
Vermont**	.0579	619	463	165	139	291	240	1.76	1.73	
Virginia		51	24	3	3	44	17	--	--	
West Virginia		97	37	23	11	51	14	--	--	
Wisconsin**	.0562	673	752	183	226	335	337	1.83	1.49	
TOTALS AND WEIGHTED AGE RATIOS**		11301	11665	3216	3253	5439	59031	1.68**	1.77**	+5.36%

* Computed only for harvest areas (States) represented by at least 150 wings in the 2 years.

**Weighted age ratios are the sum of the products of State age ratios multiplied by their specific weighting factors.

Table 10.--Indexes of woodcock bunting success as indicated by the number of wings received from hunters participating in both 1967-68 and 1968-69 wing-collection surveys

State of residence	Weighting factor	Number of identical hunters	Number of envelopes 1967-68 1968-69	Number of wings 1967-68 1968-69	Average number of wings per envelope* 1967-68 1968-69	Average number of wings per hunter** 1967-68 1968-69
Ala.		3	21	16	48	34
Ark.		3	8	8	11	11
Conn.**	.0252	56	174	184	335	410
Del.		3	6	6	10	6
Ga.		9	13	17	14	20
Ill.		1	2	3	2	9
Ind.		9	37	34	84	83
Ky.		1	1	1	2	1
La.**	-.0472	23	94	120	245	337
Maine**	.1091	95	573	545	1574	1688
Md.		5	26	35	48	92
Mass.**	.0365	46	207	178	488	439
Mich.**	.1954	75	436	410	1147	1092
Minn.**	.0111	22	74	83	234	212
Miss.		1	3	1	5	1
Mo.		2	3	3	8	5
N.H.**	.0324	42	183	230	429	593
N.J.**	.0301	77	309	332	706	853
N.Y.**	.1776	108	521	468	1392	1239
N.C.		8	14	17	16	19
Ohio**	.0475	42	147	147	398	376
Pa.**	.1737	90	376	377	983	1018
R.I.		8	19	19	36	45
S.C.		9	13	19	20	45
Tex.		2	5	14	8	34
Vt.**	.0579	28	211	176	545	401
Va.		5	23	14	51	24
W. Va.		7	33	19	83	31
Wis.**	.0562	60	225	254	580	678
TOTALS AND WEIGHTED AVERAGES**		840	3757	3730	9502	9796
					2.6**	2.7**
						12.9** 12.8**

* Computed only for States represented by at least 10 identical cooperators for the 2 years.

** Weighted average is the sum of the products of State averages multiplied by their specific weighting factors.

Table 11.--Synopsis of woodcock hunting regulations in four northern States - 1960-61 to 1968-69^{1/}

Year	Maine			Mass.			State			Mich.			N.Y.		
	Daily Bag	Days in Season	Opening Date	Daily Bag	Days in Season	Opening Date	Daily Bag	Days in Season	Opening Date	Daily Bag	Days in Season	Opening Date	Daily Bag	Days in Season	Opening Date
1960-61	4	40	10/1	4	40	10/20	4	40	10/1	4	40	10/1	4	40	10/10
1961-62	4	40	10/2	4	40	10/20	4	40	10/1	4	40	10/1	4	40	10/9
1962-63	4	40	10/1	4	40	10/10	4	40	10/1	4	40	10/1	4	40	10/8
1963-64	5	50	10/1	5	50	10/10	5	50	10/1	5	50	10/1	5	50	10/7
1964-65	5	50	9/28	5	50	10/10	5	50	10/1	5	50	10/1	5	50	10/5
1965-66	5	50	9/27	5	50	10/11	5	50	10/1	5	50	10/1	5	50	10/4
1966-67	5	50	9/26	5	50	10/10	5	50	10/1	5	50	10/1	5	50	10/3
1967-68	5	52	9/25	5	52	10/10	5	57	9/15	5	57	9/15	5	65	10/2
1968-69	5	53	9/24	5	52	10/10	5	57	9/15	5	57	9/15	5	65	9/23

^{1/} Based on Federal Regulations Announcements.

Table 12.--Bureau-funded woodcock research in progress in FY 1969 in the United States^{1/}

Organization	Activity	Duration (Years)
Bureau of Sport Fisheries and Wildlife		
MBPS - Orono Field Station	Habitat, banding, and behavioral studies*	Long term
Moosehorn Refuge	Banding and habitat studies	Long term
Indiana	Develop random singing-ground survey*	2
Maine	Develop random singing-ground survey*	2
	Breeding ground banding*	5
	Behavioral studies (telemetry)	3
Minnesota	Develop random singing-ground survey*	2
	Behavioral studies (telemetry)	3
New Hampshire	Develop random singing-ground survey*	2
New York	Develop random singing-ground survey*	2
	Breeding ground banding*	5
North Carolina	Develop random singing-ground survey*	2
Pennsylvania	Breeding ground banding*	5
Vermont	Develop random singing-ground survey*	2
West Virginia	Breeding ground banding*	5
Wisconsin	Develop random singing-ground survey*	2
	Breeding ground banding*	5

*Funds made available through the Accelerated Research Program for Shore and Upland Migratory Game Birds.

^{1/}In addition, the following Provinces and States are supporting projects under one or more of the activities listed, from their own resources and/or Federal Aid funds: Connecticut, Massachusetts, Michigan, Virginia, and West Virginia.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of this department of natural resources.

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DEPARTMENT OF THE INTERIOR
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